Research Paper Review

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Foot Posture, Leg Length Discrepancy and Low Back Pain – Their Relationship and Clinical Management Using Foot Orthoses – An Overview

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ABSTRACT

Mechanical low back pain (LBP) is a very common, expensive, and significant health issue in the western world. Functional musculoskeletal conditions are widely thought to cause mechanical low back pain. The role of foot posture and leg length discrepancy in contributing to abnormal biomechanics of the lumbopelvic region and low back pain is not sufficiently investigated. This critical review examines the evidence for the association between foot function, particularly pronation, and mechanical LBP. It also explores the evidence for a role for foot orthoses in the treatment of this condition. There is a body of evidence to support the notion that foot posture, particularly hyperpronation, is associated with mechanical low back pain. Mechanisms that have been put forward to account for this finding are based on either mechanical postural changes or alterations in muscular activity in the lumbar and pelvic muscles. More research is needed to explore and quantify the effects of foot orthoses on chronic low back pain, especially their effects on lumbopelvic muscle function and posture. The clinical implications of this work are significant since foot orthoses represent a simple and potentially effective therapeutic measure for a clinical condition of high personal and social burden.

ANALYSIS

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Background Information

Ninety percent of low back pain (LBP) episodes are thought to be musculoskeletal in nature, likely due to biomechanical abnormalities such as lumbar joint stiffness, hypertonicity, weakness of the low back

muscles, abnormal postural loading, and lower extremity postural changes. Since the available literature on the latter relationship has not been examined adequately, this review sought to critically examine the biomechanical mechanisms that may be involved in the foot-to-low back relationship, and how foot orthoses might be used to manage LBP.

SUMMARY

LBP and Leg Length Discrepancy (LLD)

Many clinicians surmise that LLD might cause LBP due to a lateral tilt of the pelvis and lumbar spine, causing asymmetrical weight bearing and chronic functional changes. Let's explore the evidence:

- One study (1) induced a LLD and lateral pelvic tilt in asymptomatic individuals. There was a positive correlation between changes in LLD/lateral pelvic tilt and LBP.
- Inducing an LLD with a foot orthotic in asymptomatic volunteers can produce a significant asymmetrical lateral bending of the spine during gait. These postural changes and abnormal weight bearing associated with LLD have been correlated with hip OA in people with radiographically confirmed LLD of 12.2 mm (2).
- In people who have had hip arthroplasty, those with greater than 10 mm LLD post-surgery have poorer functional outcome scores.
- Functional and structural LLD have been correlated with LBP, sciatica and abnormal joint posture. EDITOR'S NOTE: *This type of correlation cannot confirm a cause and effect relationship, however. This topic remains very controversial in the literature, with influential authors like Chaitow (9) and Lederman (10) maintaining that postural-structural-biomechanical factors have little to do with LBP in most cases.*
- It is generally agreed upon that a LLD > 9 mm is needed to cause structural and postural changes that can result in LBP (3). However, the prevalence of LBP caused by LLD is unknown.
- Clinical methods such as tape measure or standing block techniques have been shown to be less reliable than radiographic measurements. However, block techniques are more reliable than tape measure techniques.

Foot Posture & Lumbopelvic Muscular Dysfunction

Both postural and structural abnormalities in the feet are believed to be associated with LBP due to their ability to cause negative changes in muscle function and biomechanics of the low back, which may cause undue stress and strain. The evidence shows:

- People with mechanical LBP are more likely to have an average of 2.2° less dorsiflexion of the right ankle, and 1.7° in the left (4). The same study also showed that greater values of navicular drop (an average of 1.7 mm on the right and 1.6 mm on the left) is also related to LBP (4). It should be noted that the authors were unfortunately unable to replicate these findings in a later study.
- Another study detected less shock force in those with *higher medial longitudinal arches in their feet*, indicating that more supinated foot posture may be capable of greater shock absorption. They concluded that pronated feet may afford less shock absorption to the lumbar spine, which is consistent with the supposition that foot pronation is a risk factor for LBP.
- An anteriorly tilted pelvis (compared to the contralateral innominate) can be induced with subtalar pronation. Interestingly, supination does not affect pelvic tilt. Also noteworthy is the fact that the

authors found no significant changes in lumbar spinal posture in response to changing subtalar pronation.

- It has been shown that asymptomatic individuals with an LLD of > 3.18 mm have an approximately 38% decrease in endurance of the erector spinae and QL muscles, and this finding has been correlated with LBP. It is important to note that fatigue MIGHT beget excessive weight bearing of the lumbar spinal joints, and arrives prior to pain.

Foot Orthoses & Treatment of LBP

- The mechanism defining the therapeutic effect of foot orthotics in LBP is unclear, although some speculate that it might have an effect on the pattern of activity in the musculature of the lower back during the gait cycle. Insertion of mechanical wedges bilaterally (as opposed to heel lifts) showed an earlier activation of the erector spinae and a later activation of the gluteus medius. These changes need to be examined further in a study performed on symptomatic subjects (5).
- Others believe that orthotics might have an effect on shock absorption, as one study has documented significant shock absorption on both sides of the low back during running in asymptomatic subjects (6). A separate study on nurses showed that 5 weeks of wearing shoe inserts alleviated LBP in 15 out of 20 student nurses with LBP and leg pain (7). This is important, as some data has shown that when fatigued, the body is less able to attenuate shock forces from the feet.
- Recent RCTs have found similar results in people suffering from chronic low back pain over a 6 week period (8). However, more studies in this domain need to be performed, as some had too low baseline scores on the Oswestry Disability Index (ODI) for a clinically relevant difference to be detected. These studies did however show an appreciable change in visual analogue scale (VAS) ratings.
- At this point, the greatest amount of research effort needs to be done on determining which populations might benefit from preventive use of orthotics.
- A standard protocol for future studies which includes a baseline examination of foot posture needs to be created and performed. Additionally, future studies should include those with chronic recurrent LBP in an attempt to identify which subpopulations might benefit from orthotic prescription as the primary mode of therapy.

CLINICAL APPLICATION & CONCLUSIONS

There is growing evidence to support the clinical use of different types of orthotics for the treatment of chronic LBP. The possible mechanism is a change in the firing pattern of spinal and pelvic musculature, chiefly the lumbar erector spinae and gluteus medius. Still, more studies need to be conducted on symptomatic individuals to ascertain a potential cause and effect relationship.

Changes in pelvic posture, as well as structural and functional LLD have been associated with chronic LBP. Orthotics can have a positive influence on foot posture, offering another mechanism leading to better outcomes in the treatment of chronic LBP.

The authors conclude that while more needs to be added to this growing body of literature, foot orthoses are a relatively simple therapeutic measure with potential utility for managing chronic LBP.

STUDY METHODS

This was a narrative literature overview. The authors conducted a search using a number of databases, including PubMed, Cochrane Library and Google Scholar, with appropriate keyword searches. The reference lists of relevant papers were also screened.

STUDY STRENGTHS / WEAKNESSES

Weaknesses

- The study did not speak about any possible or reported negative effects of using orthotics as a treatment modality on LBP. This would have made for a more complete discussion of this topic.
- No statistical analysis was performed to determine a possible cause and effect relationship between using orthotics and positive changes in LBP. This is likely because the current research doesn't allow for such a meta-analysis or systematic review to be performed.
- In addition, many of the biomechanical studies performed in an attempt to understand the mechanism behind the effect of orthotics have been done on asymptomatic subjects. Many of these studies should be replicated in clinical studies on truly symptomatic people.
- Only 3 databases were accessed, which may have limited their yield on the literature search.

Strengths

- The authors proposed a few possible and reasonable mechanisms for how people suffering from LBP might benefit from the use of orthotics.
- They also outlined the paucity of research on this topic and proposed ways on how future research studies might strengthen this relationship.

Additional References

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